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UNITED STATES DEPARTMENT OF AGRICULTURE
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BETTER GINNING FOR BETTER COTTON IN NORTH CAROLINA

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Paper presented by the senior author before a meeting of the North
Carolina Cotton Ginners' Association, Raleigh,
August 7, 1941.

INTRODUCTION

There has been, from the standpoint of staple length, a gradual increase in the quality of North Carolina cotton in recent years, but there has been a corresponding decrease in quality insofar as the grade of the cotton is concerned; and there apparently has been no appreciable improvement in quality from the standpoint of ginning preparation. During the 8-year period, 1933-40, for which ginning preparation data are available, an average of about 8 percent of the state crop was roughly ginned and reduced one grade or more for this reason alone. During the period of 1933-36, three-fourths of the crop, on the average, was Middling and better in grade compared with an average of less than one-half of the crop so classed during the period 1937-40. An average of only about 8 percent of the cotton was 1-1/16 inches and longer during the period of 1933-36, as contrasted with 24 percent for 1937-40. Undoubtedly, the increased production of cottons of longer staple length without a comparable improvement in harvesting and ginning is responsible to a great extent for the increased proportion of cotton grading lower than Middling in quality. The longer cottons do not respond to mechanical cleaning as well as the shorter cottons, and they are more difficult to gin smoothly, especially if they contain an excess of moisture. It is obvious that in cotton quality preservation more care in both harvesting and ginning is required for the longer than for the shorter cotton.

HARVESTING AND HANDLING METHODS AFFECTING LINT QUALITY

Green, damp, or wet cotton, if ginned without drying, results in rough preparation and grade penalties that amount to as much as one or two grades. These penalties expressed in dollars and cents, may range from $1 to $10 or more per bale, depending on the moisture content and staple length of the cotton, and the prevailing premiums and discounts. To permit good ginning, cotton picked in a green and damp or dew-laden condition should be dried naturally or artificially before it is ginned. It is desirable for rain-soaked cotton to dry on the plant in the field, but such cotton should not be allowed to remain there, subject to weather exposure and micro-organisms, until the resulting damage is nearly as bad as it would be from wet picking and wet ginning. A month of exposure in the field in most cotton states causes an average quality loss of one grade, or a money loss of from $1 to $5 per bale.

Ginning tests have shown that lint ginned from hand-picked seed-cotton ginned after cleaning with cylinder cleaners and big drum cleaning feeders varies as much as two grades because of the difference in cleanliness of picking. The loss of about two grades because of careless harvesting will result in a loss, on a bale-value basis, of from $4 to $6 on cotton 1-1/8 inches and longer, and as high as $3 on 15/16-inch cotton. When more than usual care is taken in picking, the average difference will be a full grade. The full grade advantage of very clean picking in terms of bale value will often approximate $3 with long-staple, and more than $1 with short-staple cotton. Other tests made at the Department's cotton ginning laboratory on a wide range of cottons show that, although an elaborate cleaning set-up will improve by 1-1/2 grades the quality of the lint from the snapped cotton, there will be an average market-value difference of $3 per bale in favor of handpicking.

GINNING EQUIPMENT AND PRACTICES INFLUENCING GINNING QUALITY AND EFFICIENCY

Cotton drying and cleaning machinery have gone a long way toward preserving and improving the quality of American cotton. With the proper use of commercial drying machinery and by ginning with a loose seed roll, it has been found that the monetary value of green, damp or wet cotton is from $2 to $7 per bale higher than for similar cotton ginned without conditioning and with dense seed rolls. The improvements have a direct relationship with the moisture content and staple length of the cotton, they being more pronounced as the moisture content or staple length of cotton is increased.

Cotton Drying. In laboratory tests, the use of driers has been found to increase the market value of lint ginned from green, damp, or wet cotton by as much as $2.50 per bale for long staple cotton as a result of smoother ginning and higher grades which are associated with reductions made in the moisture content of cotton at the time of ginning. Staple length, on the average, was preserved when the cotton was dried at 150° F., but higher drying temperatures sometimes resulted in ginned lint with slightly shorter staple length. In many cases, drying temperatures above 200° F. were associated with shortening of staple to an extent of 1/32 to 1/16 of an inch. Fiber strength was not weakened by drying the seed cottons at temperatures up to 200° F., but repeated passage of the cotton through the drier at high temperatures resulted in a weakening of the fibers.

Spinning tests made in the Department's laboratories over a period of years on undried and dried cottons have shown that temperatures above 200° F. definitely resulted in weaker yarns; but when the recommended temperature of not more than 160° F. was used in drying, the studies showed that the grade of the cotton was definitely improved without a significant loss in strength of the yarn 1/. In tests of 8 different cottons ginned both in a green and damp condition and after having been dried at temperatures up to and including 190° F., the dried cotton produced yarns that were only 1 percent weaker than those spun from undried cotton. Such a decrease would be negligible from any practical standpoint in the manufacture of cotton. The benefits from drying were reflected in lower waste removed by the picker and carding machinery; and the difference in waste removal was about as much as the average difference in waste between Middling and Strict Middling cotton.

During the 1940 ginning season there were 32 cotton driers in operation in North Carolina gins; that is to say that about 4 percent of the active gins were equipped with these units as compared with more than 11 percent for the Cotton Belt as a whole.

Based on reports from one-half of the ginners who operated cotton driers in North Carolina in 1940, it is estimated that more than 33,000 bales were dried in these units when the cotton had been harvested in a green, damp, or wet condition, and that over 11,000 bales were conditioned and cleaned when the cotton had been brought to the gin in a dry condition. According to these reports, an average of almost 70 percent of the cotton ginned by the drier-equipped gins in the State was passed through driers operated with heat, for conditioning and cleaning; and the remainder was passed through the units without heat, for cleaning. The reports also indicated that the drying and cleaning benefits in terms of bale value increases averaged $4.75 for green, damp, or wet cotton and 50 cents for dry cotton, while fuel costs averaged only 14 cents per bale. Ginning capacity increases associated with drying of cotton in North Carolina averaged 22 percent with moist cotton.

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Cotton Cleaning. Individual extractor cleaner-feeders installed on the gin stands have been found to be more effective in cleaning trashy cotton than the overhead drum cleaners of four to eight cylinders; and they are now standard equipment in modern commercial gins. In tests performed at the U. S. Cotton Ginning Laboratory, the grade improvements associated with cleaning trashy cotton with these unit extractors ranged from an average of one-third of a grade on cotton 1-1/8 inches and longer to an average of two-thirds of a grade on cotton shorter than 1-1/8 inches. These benefits were equivalent to increases in bale value of about $1 in each instance. So, it is no wonder that many of the North Carolina ginners who have modernized their gins in recent years have replaced their drum feeders with extractor cleaner-feeders. The feeder gives the gin saws and ribs good protection from foreign matter that would otherwise increase wear and tear on these important parts of the gins.

1/ Campbell, Malcolm E., Some spinning test results of interest to cotton manufacturers. Agr. Mktg. Serv., June 1940. (Mimeographed)

Cotton Gin Operating Practices. In laboratory tests, losses in bale value resulting from ginnings made with tight seed rolls as compared with the value of lint from corresponding portions of seed cotton ginned with loose seed rolls, ranged from 60 cents on the dry, short-staple cottons to $4.50 on the dampy long-staple cottons. Therefore, loose seed-roll operation is essential, even with the dry, short-staple cottons, if smooth and superior preparation is to be obtained.

There are a number of factors that influence seed-roll density. The first of these is the feeding of a gin, of any type or condition, beyond its normal capacity. With the newer designs of gins, this is about the only cause of dense-roll operation. With the older gins that operate with slow saw speeds and that have been neglected so far as repairs of important parts are concerned, satisfactory capacity can be attained only with dense seed-roll operation. Such operation, however, causes rough preparation. Furthermore, if the saws have been neglected and are off in pitch and dull or badly worn, they will not be efficient in removing the lint from the seed and the result will be denser seed rolls; there will be a consequent "napping" or poor preparation of the lint and losses in bale value ranging from $1 to $2. Similarly, inadequate doffing of the lint from the saws, because of badly worn or improperly adjusted brushes in brush gins, or because of a run-down, air-blast system in air-blast gins, will produce tighter seed rolls at a given rate of feed than with efficient doffing mechanisms, and will cause bale-value losses of as much as $1 or more on moist, long-staple cotton. A seed board too nearly closed or with lengthy spikes will hinder loose seed-roll performance and cause an undesirable addition of seed coat fragments in the lint.

Tests made at the U. S. Cotton Ginning Laboratory over a period of years on about 100 cottons varying widely in staple length, foreign matter, moisture, and other conditions and qualities showed that by increasing the saw speed from 400 to 600 revolutions per minute in ginning with loose seed rolls, the average increase in ginning capacity amounted to 20 percent for both long and short staple cotton. There was an average increase in bale weight of 20 pounds for long staple and 15 pounds for short staple cotton; and an average increase in bale value of $2.50 on long staple and about $1.50 on short staple cottons.

In connection with some of the gin operating practices that have a marked influence on the quality of ginning, it should be of interest at this point to examine the results of field surveys made by the laboratory in commercial gins across the Cotton Belt during the 1940 ginning season, particularly the findings in regard to the influence of different gin-saw speeds, gin-saw conditions, and gin-saw diameter reductions on seed-roll density and ginning time.

With respect to observations of saw speed, the surveys in about 500 commercial gins brought out the fact that loose seed rolls, which provide smoother ginning than dense seed rolls, were employed in about 87 percent of the gins operating with saw speeds above 650 revolutions per minute; in about two-thirds of those running with speeds of 551 to 650 revolutions per minute; in one-half of those with speeds of 451 to 550 revolutions per minute; and in only 42 percent of those with speeds of 450 revolutions per minute and below.

These findings show a direct relationship between gin-saw speed and the proportion of gins operating with loose seed rolls. The ginning time ranged, from, on the average of 63 minutes per bale per gin stand for the high-speed gins to an average of 82 minutes for the low-speed gins. These observations are in line with findings made available through long-time laboratory tests of variations in gin-saw speed and seed-roll density.

It was also found that a direct relationship existed between seed-roll density and gin-saw condition and gin-saw diameter, as well as between ginning capacity and each of these two elements of the gin saws. Of the gins operating with saws in good condition, two-thirds employed loose seed rolls; of those operating with saws in fair condition, less than one-half used loose seed rolls; and of those operating with poor saws, only one-third ginned with loose seed rolls. The ginning time averaged about one hour per bale per gin stand in the gins having good saws and about 1-1/2 hours in those operating with poor saws. Relationships between definite reductions in saw diameter and seed-roll density and ginning time were similar to those between gin-saw condition and these two elements of ginning.

When classifying the gins by definite intervals of saw-diameter reduction associated with wear and sharpening, the data revealed that with 12-inch diameter saws, the percentage of gins operating with loose seed rolls was 70 percent; and with 11-15/16 inches, it was 57 percent; with 11-7/8 inches, it was 42 percent; and with 11-27/32 inches and below, only 30 percent. Ginning time per bale ranged from 65 minutes for gins with 12-inch saws to 80 minutes for gin stands having saws with diameters of 11-27/32 inches and below. All these field observations confirm laboratory data obtained with these various elements of ginning in controlled experiments at the U. S. Cotton Ginning Laboratory.

In the light of these practical field verifications of laboratory results relating to the effects of differences in gin-saw speed, condition, and diameter on ginning quality and efficiency, many North Carolina ginners can make profitable changes in these elements of their gins. Some operators of slow-speed gins, as well as those of gins with saws in poor condition and badly worn, have already given attention to correcting these elements of ginning, but there are still many opportunities for making improvements of this kind in North Carolina gins. Since the cost of saw speed changes are generally nominal, the improvements in these respects are practicable in most cases.

The cost of the new pulleys needed in making the changes seldom exceeds $20 per gin stand. When the feeders and picker rollers are driven from the saw shaft in either direct-connected or independent saw-and-brush drives, their speed will be in proportion to saw speed increases; but in direct-connected drives other units may also be involved, such as fans, condenser, distributor, separator, and press pump. In either case, therefore, the feeder pulleys and other machine pulleys must be replaced with larger ones in order to retain the original speeds of everything but the saws. The picker rollers, however, can usually stand increases in saw speeds of up to 100, and in some cases more, revolutions per minute without needing larger driven pulleys.

With independent saw and brush drives, the line shaft is generally operated at about 400 revolutions per minute. If the saws are running at this speed, both the driving and driven pulleys will be the same size, usually up to 24 inches each in diameter. To increase the saw speed to 600 revolutions per minute in this case, the driven pulley on the saw shaft would be reduced one-third in size, or from 24 to 16 inches. Of course, the driving pulleys on the line shaft can be increased in size to produce the same saw speed increases, but changes there also involve longer belts and are more expensive than on the saw shaft. When saw speeds are increased in brush gins, the brush speed should not be changed. If the brushes are belted separately to the line shaft, their speed will be unchanged. However, if each is driven from its own saw cylinder, a larger pulley or other alteration will be required to bring them back to their original speed. If the gin is of the air-blast type, the same nozzle pressure should be maintained as was employed before the saw-speed increase, namely, from 11 to 13 inches of water gauge pressure.

OTHER IMPROVEMENTS IN GINNING

For better cotton, the preservation of seed purity at cotton gins is becoming more important each season; and ginners are rapidly adopting pure seed handling systems. These may be either hinged-bottom seed troughs in 2-story gins, or self-cleaning belt or air-blow systems of various designs for both single and 2-story gins. The fact that over one-third of the new gin plants installed in 1940 were equipped with these devices is evidence of real interest on the part of ginners and producers in these developments.

Also, in an effort to give better service, some ginners are improving the operation of their presses, trampers, and condensers. In these instances, old wooden presses are now being "iron bound" to increase their strength and lengthen their life; condensers are being overhauled and frequently re-vented; and trampers are being correctly timed to make more uniform packing. Kicker wheels, lint slides, lint flue deflectors and condenser speeds can be adjusted in an effort to eliminate big-ended or rolling bales.

CONCLUSION

Before closing, a few more points should be emphasized. Cotton merchants and others who buy cotton should pay prices and encourage the paying of prices that are commensurate with the quality bought, if they expect farmers to continue to grow good cotton, and to harvest and handle it carefully, and to insist upon the ginners doing a good job of ginning. When a lot of cotton offered for sale has one bale or several bales of rough cotton in it, the grower should be told about it, and of the discounts that are being made in the price, rather than offered an average price for the whole lot without calling his attention to the variation in the quality of the lot. Some buyers occasionally are not inclined to do this for the reason that they think the producer may not accept his comments in the right spirit, and may patronize the buyer who flatters the quality of his cotton.

Cotton producers, moreover, should know the general limitations of gin machinery and should be made to understand that the condition in which cotton reaches the gin largely determines the quality obtainable. Merchants and ginners can render a real service in this connection. The Smith-Doxey classification service now available to groups of producers organized to promote the improvement of their cotton has been very helpful to producers in bringing rough bales of cotton to their attention. Many of the producers report that this classification, which shows the ginning preparation, among other things, provides a basis for correcting the underlying faults.

Representatives of your State Agricultural Extension Service who work with farmers in these one-variety cotton improvement organizations are present at your meeting today. These men, along with the specialist assigned to the gin extension program in your State, have been working with your cotton producers in an effort to improve cotton harvesting and handling methods and to obtain better ginning of cotton in North Carolina. They are always pleased to work with ginners on their problems and already they have made good progress in this work. They and we realize, however, that there is an opportunity for making much greater improvement through the cooperative efforts of all concerned in the cotton industry in North Carolina.